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Dock Machinery.

W. B. HANLON.

READ AT COLUMBUS MEETING.

From the first shipment of iron ore from the Michigan mining districts, made in 1852, consisting of about two tons packed in a half dozen barrels, the trade has increased, until at the close of the year 1888, the statistics of shipments show the immense output of 5,000,000 tons, which amount is an increase of 1,107,248 tons over the output of any one year previous.

The following table of total receipts at Lower Lake ports, for the last six years, published in the "*Iron Trade Review*" of recent date, goes to show that, out of the whole shipment of 5,000,000 tons, 3,783,659 tons were received at the ports of Toledo, Sandusky, Huron, Lorain, Cleveland, Fairport, Ashtabula, Erie and Buffalo.

Table of total receipts at Lower Lake ports for six years:

Port.	1883.	1884.	1885.	1886.	1887.	1888.
Toledo	\$27,617	\$2,444	\$15,000	\$26,960	\$61,729	\$75,601
Sandusky	58,825	106,540	143,180	157,970	160,600	154,924
Huron	44,021	21,288	4,351
Lorain	25,794	30,156	13,180	99,744	134,764	197,000
Cleveland	723,129	904,850	589,234	1,034,650	1,216,423	971,795
Fairport	40,334	23,100	31,992	112,000	501,368	611,140
Ashtabula	670,000	650,000	582,000	672,000	1,103,839	1,288,530
Erie	106,787	116,027	122,223	91,250	210,488	240,338
Buffalo	40,203	8,760	7,160	31,869	28,699	240,000
Total	1,692,689	1,841,877	1,503,969	2,270,554	3,439,198	3,783,659

The statistics in the collector's office at Cleveland, for that district, include the following ports, named above: Sandusky, Huron, Lorain, Cleveland, Fairport and Ashtabula. To show the increase at these ports, both as to ore received and coal shipped, we will use the years 1880 and 1888: 1880 ore received

1,115,083 tons; 1888 ore received 3,231,310 tons. Increase in eight years, 2,116,227 tons.

COAL SHIPMENTS.

1880, 744,272 tons; 1888, 1,627,825 tons. Increase 883,553 tons.

This increased tonnage of ore and coal has shown the necessity for improvements in dock machinery, for loading and unloading cargoes, and to facilitate the handling of such material, machinery has been, from year to year, improved, and there are now in use at the different Ohio ports derricks, cranes, hoists and conveyors, known to the trade as follows, naming them in the order as to the time introduced:

Stationary derrick, Erie crane, Lyman's derrick, McMilar revolving derrick, Davis hoist and conveyor, Brown hoist and conveyor, Ludlow's hoist and conveyor, Champion hoist and conveyor, Thomberg derrick and Variety hoist and conveyor.

The stationary derricks are operated in pairs, and located about midway between dock line and the railroad tracks. The power is conveyed from an engine house located on the opposite side of the tracks from the dock, through in under tracks, platforms and dock to the foot of the mast, by a chain and wire cable. The operation of a pair requires one fireman and two machine men, with one additional to hook cable to buckets and swing them from platform to hatch. This man is not chargeable to expense of machine.

The Erie crane is mounted on wheels, and movable back and forth along the face of the dock. The hoisting and swinging gear is placed upon one end of a frame, and the boiler and engine on the other.

The operating force is the same as the stationary derrick. The movable feature is the only advantage over the stationary.

Lyman derrick and the McMilar revolving derrick are on the same principle. Mounted upon wheels, it is movable back and forth along the face of the dock. All the machinery is mounted upon a wrought iron frame, which revolves upon its center bearing.

The operating force is the same as the stationary. Its capacity is by working two derricks on one vessel, 500 tons per ten hours.

The Davis hoist and conveyor was the first improvement whereby the machinery hoisting the material from the vessel was made to carry it to any point on the dock within the length of its span, or loading from that part of the dock or from cars on parallel tracks, and delivering it in the vessel.

The Brown hoist and conveyor, the invention of A. E. Brown, C. E., was next introduced.

For loading and unloading vessels or cars, two styles have

been introduced, and known as the "cable" tramway and "bridge" tramway.

The former being especially adapted to unloading of vessels on to docks, where the material is required to be stored in large quantities, and will convey to a distance of 400 feet from the face of dock. The cable on which the buckets travel is at such a height, that stock piles may be twenty feet high in front of dock, and fifty to sixty feet at rear. The piers upon which the cables are suspended do not interfere with railroad tracks on the dock, and are movable along the dock either by hand or steam power. The engines are located in the base of the back pier, and movement of buckets is controlled by an operator in the same pier, located at such a height as to give a clear view of the vessel. The capacity for storage is 100,000 tons in one vessel length, using a tramway 375 feet in length. Three bridges can unload 1,200 tons in ten hours.

When the docks are not deeper than 250 feet, the bridge tramway is preferable. The spans are 180 feet, with an eighty foot cantilever extending from the back pier, and a thirty-seven foot hinged boom extending from front pier to a point over the vessel's hold, making a total tramway 297 feet in length.

They are generally built in plants of three or four; two of the bridges supported at their back ends upon one double back pier, the other bridge or bridges being supported singly on a single back pier. All pieces are mounted and movable, similar to the cable tramway piers.

The power and operators are located in the double back pier.

Each bridge is supported in front by an independent pier. The bearings of the bridges on the piers are so designed that the front pier can be skewed sideways enough to use three hatches in a vessel.

These machines are manufactured by the Brown Hoisting and Conveying Machine Co., Cleveland, Ohio, and are in operation at Buffalo, Ashtabula, and Cleveland. At the Cleveland meeting of this Society, in 1884, the operation of the plant on the N. Y., P. & O. R. R. ore dock was quite an item of interest to the members present.

Ludlow's hoist and conveyor has been designed upon the bridge plan, and having a boom extending over the vessel. Several machines may be operated from one engine house. They are in use at Sandusky, and have a capacity of 50 to 100 tons per machine per hour.

Champion hoist and conveyor is manufactured by the Variety Iron Works, Cleveland.

It is a truss supported on front and back piers and having a cantilever extension beyond the back pier. On the front pier is located a boom which extends over the vessel.

By an independent hoisting rope and the raising of the boom the material is hoisted from the vessel and dumped into a hopper located in the pier immediately above the end of bridge or truss. The empty bucket is drawn back to the vessel by a counter-balance weight.

Back and forth on the bridge travels a car operated by a cable traveling 400 feet per minute. The car automatically opens the hopper when run in under it and closes it when leaving.

The car is then conveyed along the bridge to the proper dumping place, and is returned by the use of a tail rope. The hopper and car have each a capacity of three tons.

In locating a plant where old trestles have been in use, the bridge is omitted and the track for conveyor is supported on the trestles. The operations and mechanical details are however the same. When the material is to be loaded direct to cars it is conveyed from hopper through a chute. The power is conveyed to each machine by an endless three-eighths cable traveling at the rate of 4000 feet per minute and passing from engine house over a driving pulley and two idlers at each pier and a pulley at opposite end from the engine, held in place by a counter-balance of sufficient weight to avoid slipping. This machine is not designed to load from cars to vessels.

The Thomburg derrick is the invention of Wm. Thomburg, General Manager of the Valley Railway, and is manufactured by the Excelsior Iron works, Cleveland. The design of this machine is a signal departure from the general design of all dock machinery heretofore built. They are built in plants of four to six derricks mounted on wheels and are movable back and forth along the face of the dock.

The lower end of the boom legs are connected to a half circle worm-wheel gearing with a worm driven from a line shaft passing through all the machines. It thus revolves in its diameter, the course of the bucket being direct from the car, through between the boom legs to face of dock or hatch.

To assist in raising the boom when unloaded, counter-balance weights are used, and so arranged as to exert the most power when the boom is in a horizontal position, either over the cars or vessel. The boom is of such a length as to reach over three tracks and load from either of them.

The engine is located at one end of the plant and connected to machines by shafting.

The force required is one engineer and one machine man to each machine.

The time required for the bucket to make one trip is forty-five seconds, and the capacity of a plant of six machines is 275 tons per hour, or a vessel containing a cargo of 2200 tons can be loaded with coal in eight hours.

When the vessel is made fast the machines are spaced to work in all the hatches and can be loaded complete without shifting.

The Variety Hoist and Conveyor is built by the Variety Iron Works and is of the bridge design, supported on piers similar to the Brown and Champion. The bridge is provided with a double track so that when a loaded bucket leaves the vessel another begins to return empty from the opposite end of bridge and passing each other at the center.

From the end of the bridge at the front pier the track curves downward to a point a short distance above the hatch where the double track is changed to single, and provided with an automatic switch so that the same bucket always uses the same track. This curved portion of the track is hinged, and can be raised to a vertical position, out of the way of vessels. Several of these machines have been erected at Ashtabula, but no record of their performance is recorded.

They are operated by the same force and power, conveyed to them in the same way as to the Champion machine.

The usual size of bucket for coal contains one ton, and is made of boiler iron, with heavy plank bottom. The latest improved bucket is made of light boiler iron, and mounted on three small wheels, and so balanced that when empty it can be easily handled on the platform by one man.

Such has been the advance in improvements of dock machinery that it is now possible for the largest vessels that enter our ports to discharge their cargo, and again reload within twenty-four hours, when but a few years ago it required from thirty-six to forty-eight hours.

Vessel owners have availed themselves of these improvements, and seek ports at which their cargoes may be discharged, and the vessel again reloaded in the least possible time and in the best manner.

The requirements of service are, portability, speed, adaptability as a conveyor from vessel to cars or stock pile, from stock pile to cars, and from cars to vessel, with the greatest saving in time, and minimum cost of operation and repairs.

Does the machinery now in operation in season at our different ports fulfill these requirements? In part it does.

DISCUSSION OF MR. HANLON'S PAPER.

Mr. Haseltine: I would like to ask Mr. Hanlon what the probable cost per day or per ton is, of loading and unloading vessels with the most approved machinery now in use?

Mr. Hanlon: The price per ton for the "dead work," as it

is called, is about one and seven-tenth cents per ton, the company furnishing the power, which includes of course the engineer and machine men.

Mr. Hanlon then exhibited to the Institute a design of the Brown hoisting apparatus which was examined by the various members and its workings explained by Mr. Hanlon.

Mr. Haseltine: How many men does it require to operate it?

Mr. Hanlon: It requires four men.

Mr. Haseltine: Are they all skilled mechanics?

Mr. Hanlon: One is an engineer and the other three are machine men, who are not required to be particularly skilled, but men who are able to handle a lever.

Mr. Haseltine: How does the cost of loading and unloading compare?

Mr. Hanlon: Just about the same.